Kalorimetri

Beregning på varme

Eks

Temp 20°C

Skal varmes opp

Temp 100°C

Varme energi: Q

$$Q = c \cdot m \cdot \Delta t$$

Δt: $20 \to 100 = 80\ K$

1 ltr vann $\Rightarrow$ 1,0 kg

c: i tabell

Spesifikk varmekapasitet for vann

I tabell: $4{,}18\ \frac{kJ}{kg \cdot K}$

$$Q = 4{,}18 \cdot 1{,}0 \cdot 80 \left[\frac{kJ}{kg \cdot K} \cdot kg \cdot K\right]$$

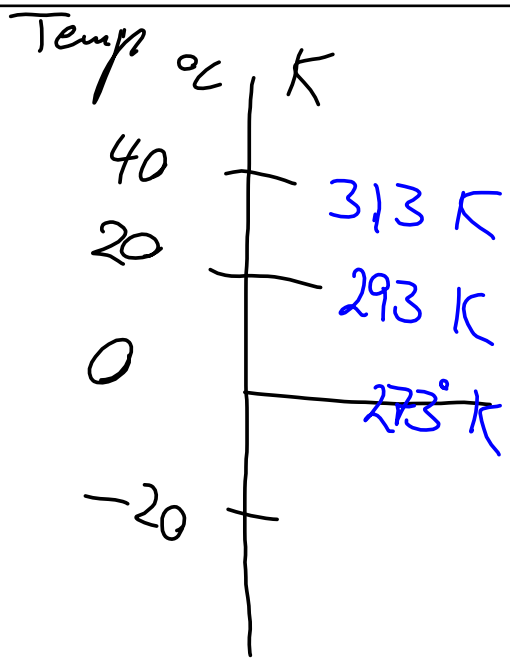
$$Q = 334\ kJ$$

Elektrisk energi

$Q = E = 334\ kJ$

$P \cdot t = 1000\ W \cdot t = 334\ kJ$ (W·s)

$$t = \frac{334 \cdot 10^3\ J}{1 \cdot 10^3\ W} = 334\ s$$



: °C :

40 − 20 = 20 °C

313 − 293 = 20 K

Varmekapasiteten til et legeme

$$Q = C \cdot \Delta T$$

$$\left[\frac{J}{K}\right]$$

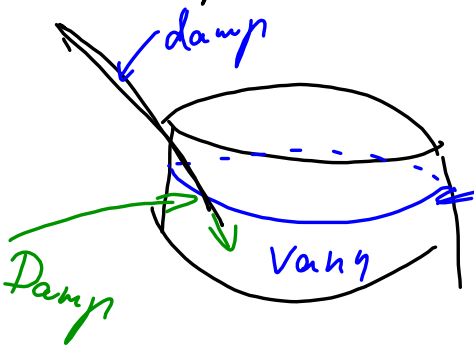
Fasevarme

$$Q = L \cdot m$$

L: spesifikk fasevarme (i tabell)

Eksempel (forts. 18)

Side 193 i læreboka



Start temp: 20°C

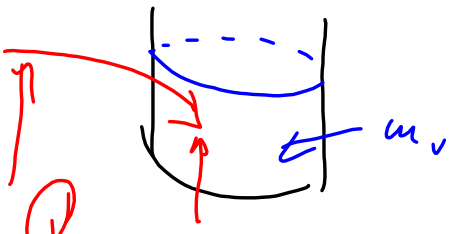
$m_d = 5{,}0\ g$ Denne kondenseres til vann (fra dampen) da den kommer ned i vannet

Kondenseringsvarme avgis fra dampen til vannet

Nå har vi 5,0 g vann på 100°C

Dette brukes til å varme opp vannet

Da brukes den spesifikke varme kapasiteten for vann



$Q_{kond} + Q_{d\,vann} = Q_{vann}$

20°C

$L_d \cdot m_d + c_v \cdot m_d (t_d - t) = c_v \cdot m_v (t - t_v)$

t_d: 100°C; t: Temp vannet får

7.11

a) $Q = c \cdot m \cdot \Delta t$

c = spesifikk varmekapasitet

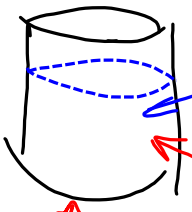
$$c = \frac{Q}{m \cdot \Delta t}$$

Q ← varmeenergi

Δt ← temperaturendring

m ← masse

b)



$m = 480\,g = 0{,}480\,kg$

Oppvarming

P (effekt)

$\Delta t = 31{,}2 - 16{,}5 = 14{,}7\ K$

$Q_{TOT} = E = 150\,[W] \cdot 100\,[s] = 15000\,[W \cdot s] = 15\,[kJ]$

$$c = \frac{Q}{m \cdot \Delta t} = \frac{15\,[kJ]}{0{,}48\,[kg] \cdot 14{,}7\,[K]} = 2{,}13\left[\frac{kJ}{kg \cdot K}\right]$$

c) Benzen: $c_B = 1{,}74\ \frac{kJ}{kg \cdot K}$

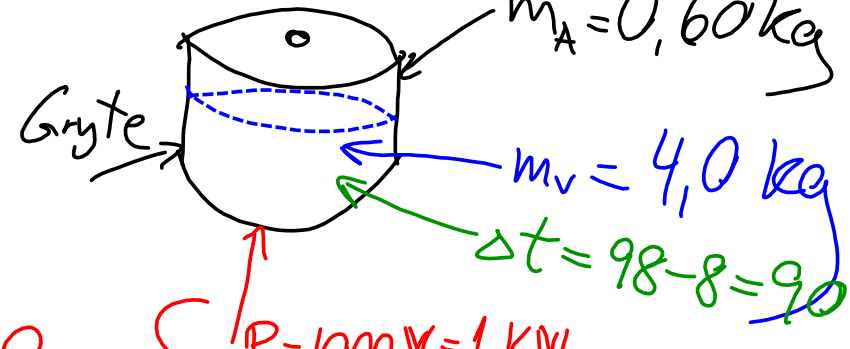
$Q_{TOT} = Q_B + Q_{kap} = 15{,}0\,[kJ]$

$Q_B = c_B \cdot m \cdot \Delta t = 1{,}74 \cdot 0{,}48 \cdot 14{,}7\left[\frac{kJ}{kg \cdot K} \cdot kg \cdot K\right]$

$= 12{,}3\,[kJ]$

$Q_{kap} = Q_{TOT} - Q_B = 15{,}0\,[kJ] - 12{,}3\,[kJ] = 2{,}7\,[kJ]$

7.12



Q_T { $P = 1000\,W = 1\,kW$, t ?

Gryta, vannet

$$Q_T = P \cdot t = Q_A + Q_V$$

$$Q_A = c_A \cdot m_A \cdot \Delta t = 0,90 \cdot 0,60 \cdot 90 = 48,6\,kJ$$

$$Q_V = c_V \cdot m_V \cdot \Delta t = 4,2 \cdot 4,0 \cdot 90 = 1512,0\,kJ$$

$$Q_T = P \cdot t = Q_A + Q_V = 48,6 + 1512,0 = 1560,6\,[kJ]$$

$$t = \frac{Q_T}{P} = \frac{1560,6\,kJ}{1,0\,kW} = 1560,6\,[s]$$

$[W \cdot s] = [J]$